

# Analysis of EDCs and Pharmaceuticals By LC-MS/MS



**Brett Vanderford & Shane Snyder**  
*Southern Nevada Water Authority*  
*Water Quality Research and Development*

# What is SNWA Water Quality Research and Development (R&D)?

**Established in 2000**

**Group of scientists, engineers, post-graduate researchers, technicians, and undergraduate/graduate interns**

## **Goals**

- **Compete for externally funded grants**
  - Awarded over \$3,000,000 in competitive grants
- **Collaborate with other utilities and research groups**
- **Proactively study emerging contaminants**
  - Method development
  - Occurrence and fate
- **Improve treatment processes**
  - Minimize DBPs
  - Increase efficiency
- **Publish/present findings to share knowledge with others**
  - Published 40+ manuscripts in peer-reviewed journals
  - Presented findings at numerous conferences

*Anal. Chem.* 2003, 75, 6265–6274

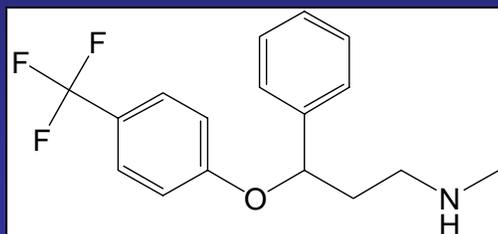
# **Analysis of Endocrine Disruptors, Pharmaceuticals, and Personal Care Products in Water Using Liquid Chromatography/Tandem Mass Spectrometry**

**Brett J. Vanderford,\* Rebecca A. Pearson, David J. Rexing, and Shane A. Snyder**

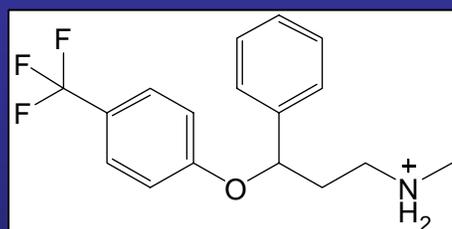
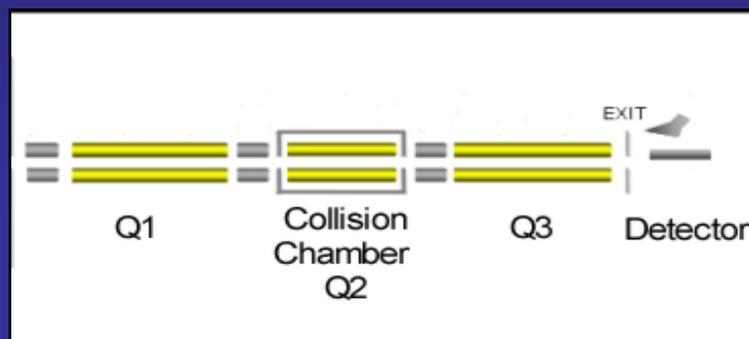
*Southern Nevada Water Authority, 243 Lakeshore Road, Boulder City, Nevada 89005*



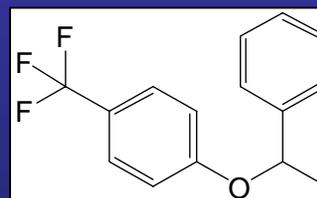
# Tandem Mass Spectrometry (MS/MS)



Fluoxetine (Prozac)  
MW: 309



Precursor (310  $m/z$ )  
(From source)



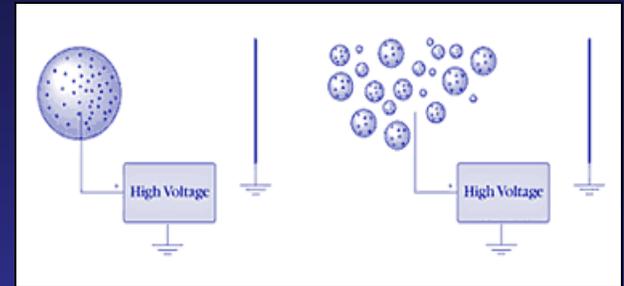
Neutral



Product (44  $m/z$ )

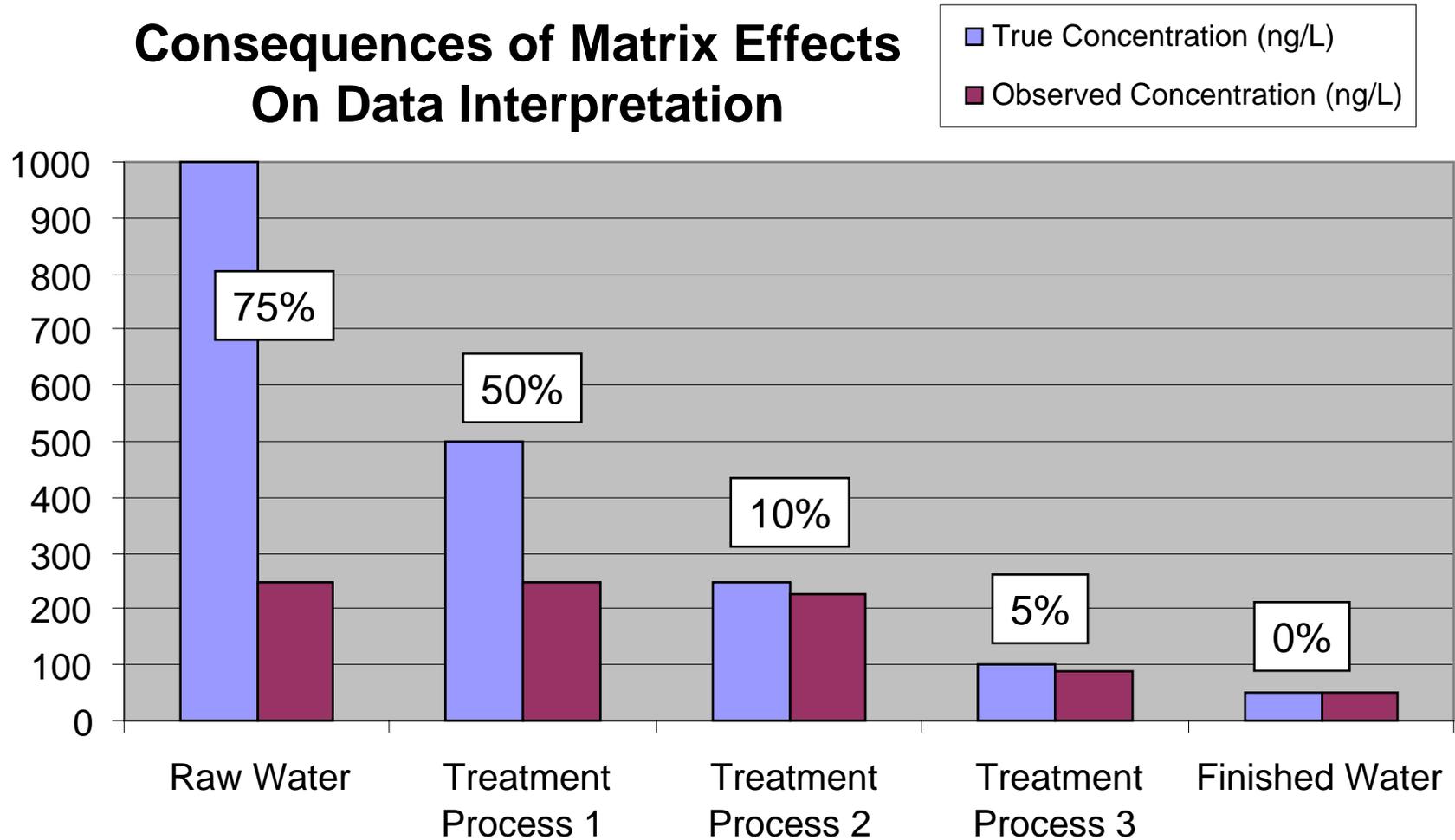
Precursor/product ion transition (310  $\rightarrow$  44) – very selective!

# Matrix Effects



- Analytes need to be charged to enter MS
- Limited pool of charge available
- Non-target compounds can prevent compounds of interest from becoming charged
- Leads to lower recoveries, uncertainty
- NOM...?

## Consequences of Matrix Effects On Data Interpretation



# Analysis of Pharmaceuticals in Water by Isotope Dilution Liquid Chromatography/Tandem Mass Spectrometry<sup>†</sup>

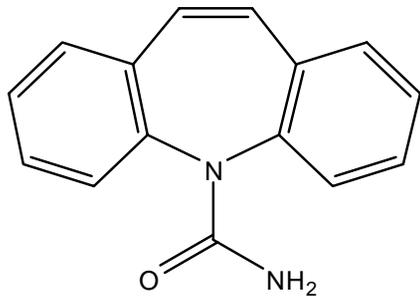
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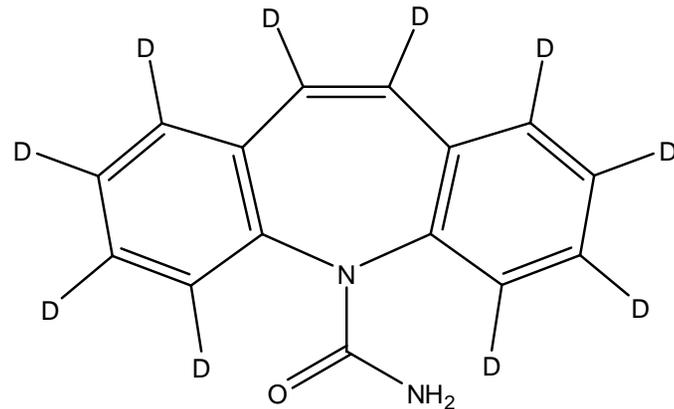
pensate for matrix effects by using different calibration techniques, including standard addition (13, 17, 22), surrogate monitoring (15, 20), and various forms of internal calibration (14–16, 19, 23). Still more have been developed to minimize matrix effects using different extraction, cleanup and elution techniques, including size-exclusion chromatography (18, 24), solid-phase extraction (22), LC chromatographic procedures (14, 22), ultra performance liquid chromatography (25), hollow fiber liquid-phase microextraction (26), flow-splitting and reduced eluent flow rates (24, 27). However, most become problematic when applied to the simultaneous analysis of a broad range of compounds that encompass many different classes and structures in matrices having varying degrees of suppression and enhancement.



# Isotope Dilution

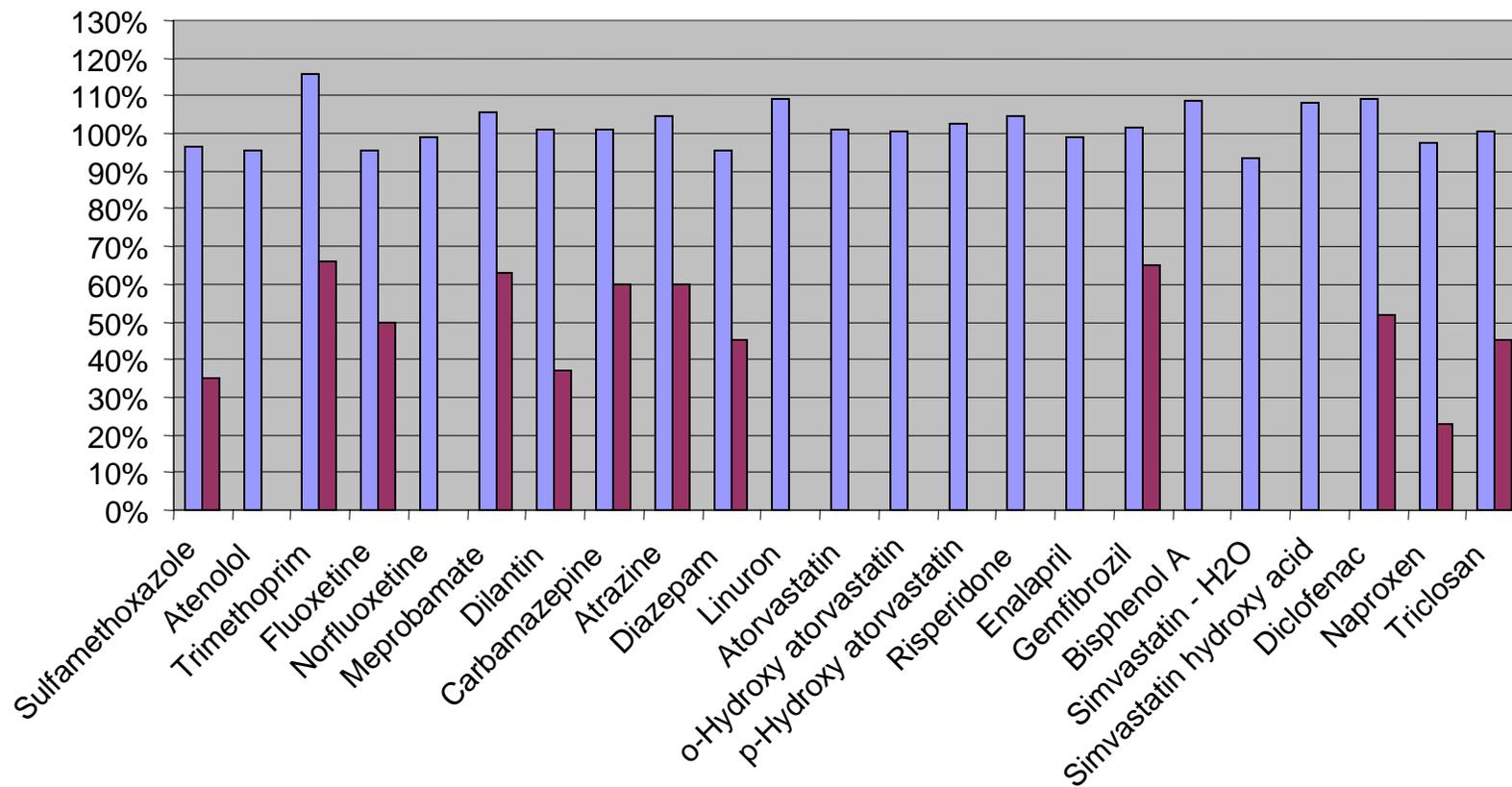
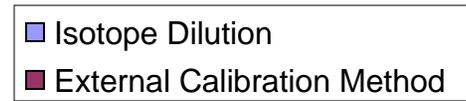


**Carbamazepine**  
Treatment for epilepsy

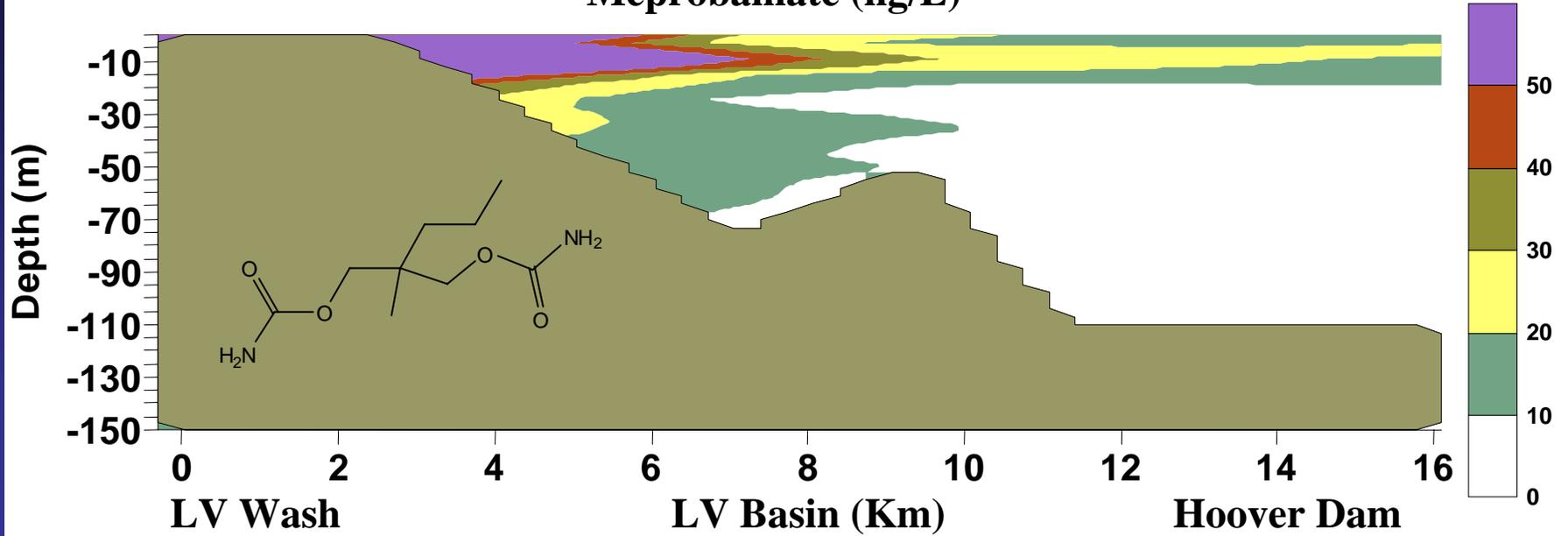


**Carbamazepine-d<sub>10</sub>**  
Non-radioactive isotope label  
Very low prob. of natural occurrence  
Chemically very similar  
Add to all samples  
Corrects for extraction losses  
Corrects for matrix effects

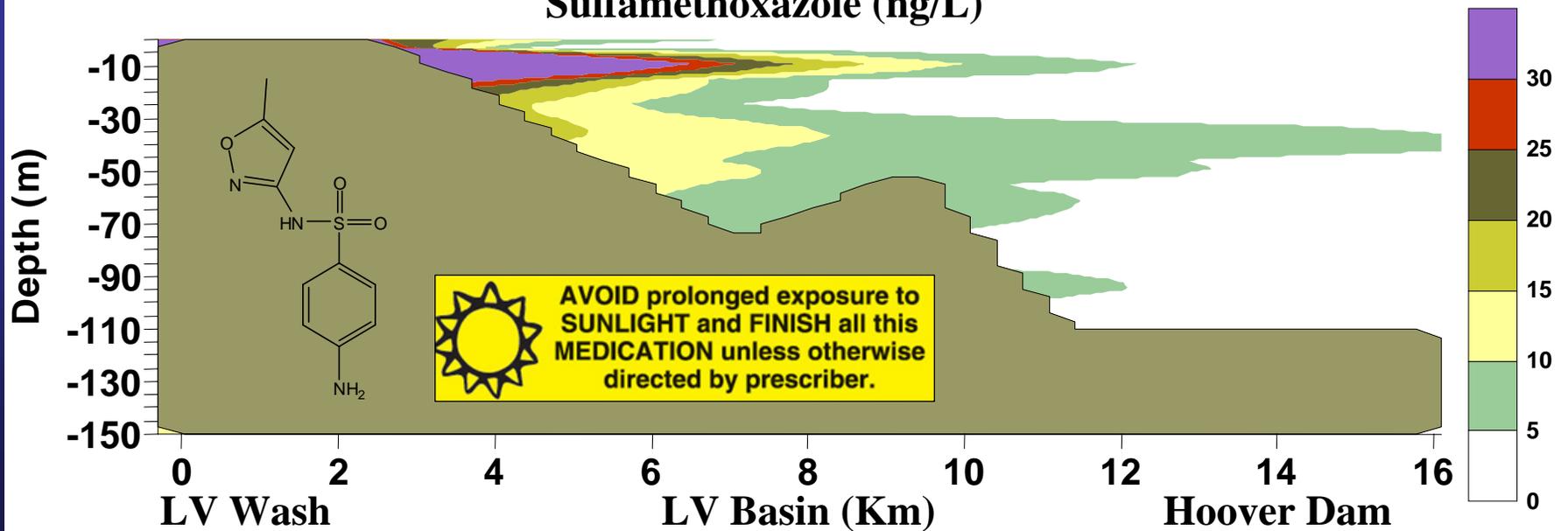
## Surface Water Impacted by Wastewater Spike @ 25 ng/L



### Meprobamate (ng/L)



### Sulfamethoxazole (ng/L)



# ***Drinking Water/Wastewater Treatment Processes (>60 EDCs/PPCPs)***



**Awwa  
Research  
Foundation**

Advancing the  
Science of Water®

**Project 2758 “Removal of EDCs/PPCPs”**

# ***Wastewater Ozonation***



**Projects 04-007 & 06-012 “Advanced Oxidation”**

# *Toxicological Relevance of Pharmaceuticals and EDCs in Drinking Water*



**AwwaRF #3085**

**WRF 04-003**



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# Thank you!



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